REPLACEMENT SHEET
Title: Method and Apparatus for Suspending Execution of a Thread
Until a Specified Memory Access Occurs
1st Named Inventor: Dion Rodgers
Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 1/13

100

BUS/MEMORY
CONTROLLER
120

BUS
CYCLE
INFO

FRONT END
130

REPLICATED
IPS

170

THREAD
PARTITIONABLE
RESOURCES
140

REPLICATED
STATE

180

MONITOR
CYCLE
INFO

112

114

MEMORY
ACCESS
MONITOR
110

RESUME
THREAD

SHARED
RESOURCES
(EU'S)
150

THREAD
PARTITIONABLE
RESOURCES
160

FIG. 1

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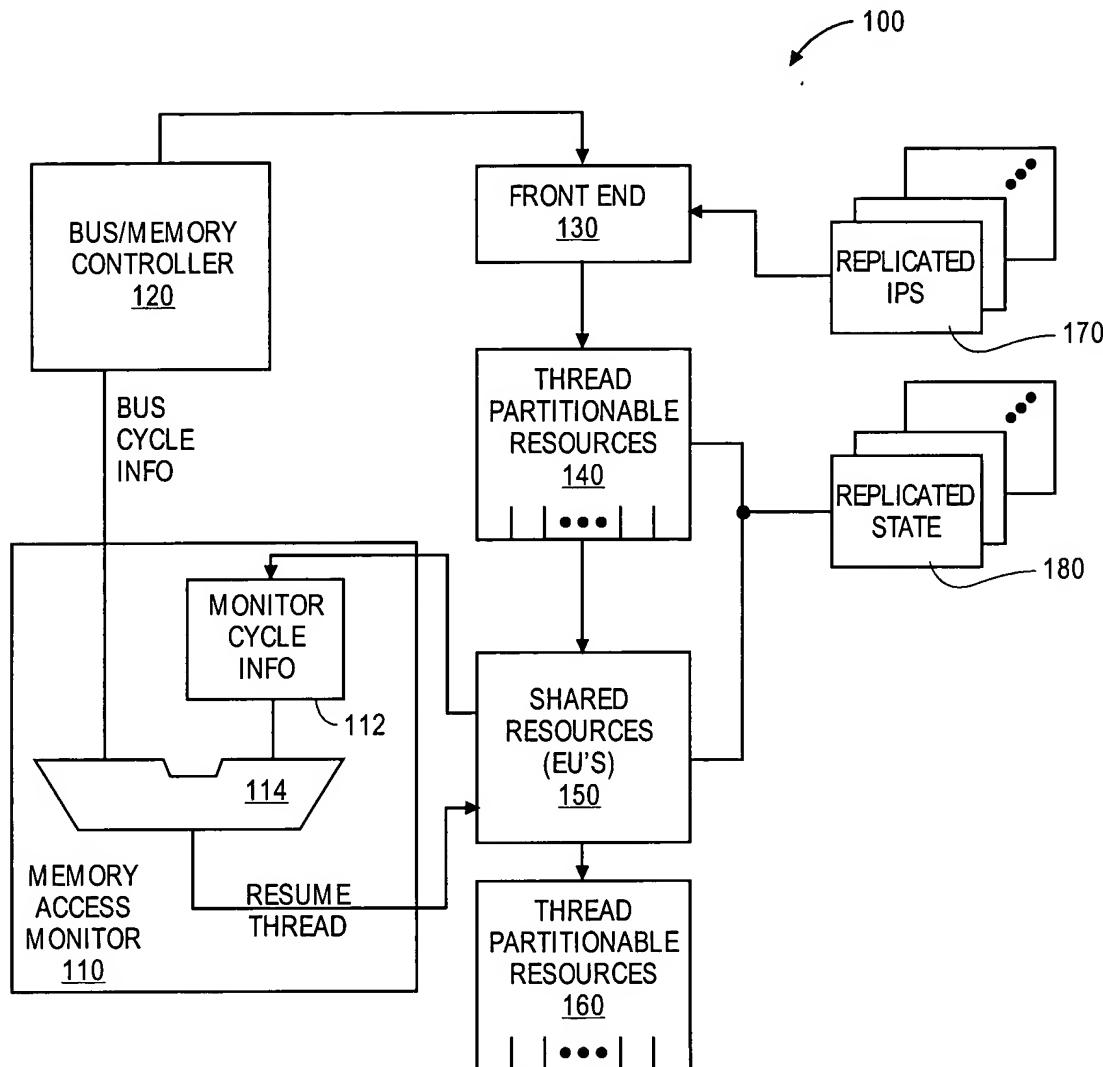Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 2/13

RECEIVE MONITOR OPCODE
AND MONITOR ADDRESS
IN THREAD 1   200

ENABLE MONITOR TO
MONITOR ACCESS   210

TRIGGER WAIT FOR
THREAD 1 (E.G., A
MEMORY WAIT OPCODE)   225

CYCLE
DETECTED?   215
NO

IMPLEMENTATION-
DEPENDENT STATE

SUSPEND
THREAD 1   235

MONITOR
ENABLED?   230
YES

NO

SET MONITOR
EVENT PENDING   220

YES

MONITOR
EVENT
PENDING?   240
YES

NO

CONTINUE/RESUME
EXECUTION OF
THREAD 1   250

FIG. 2

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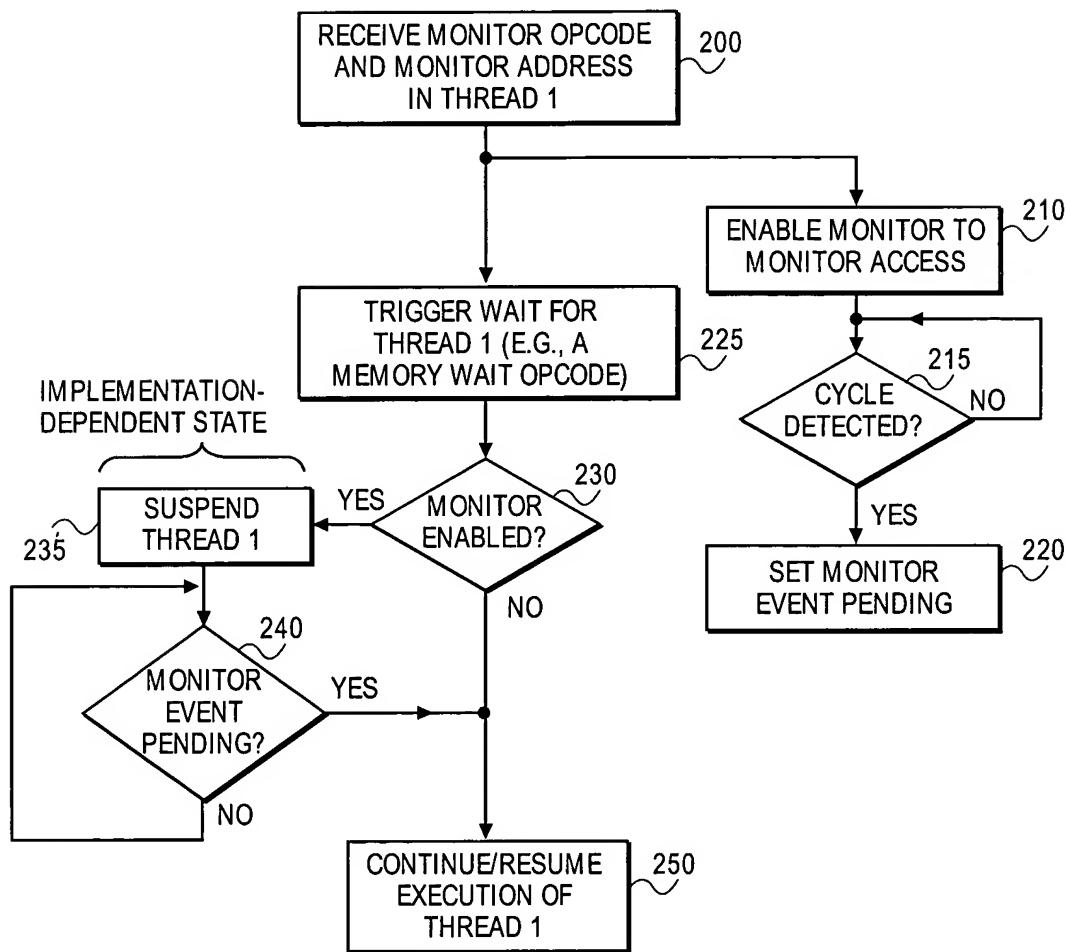Sheet: 3/13

FIG. 3

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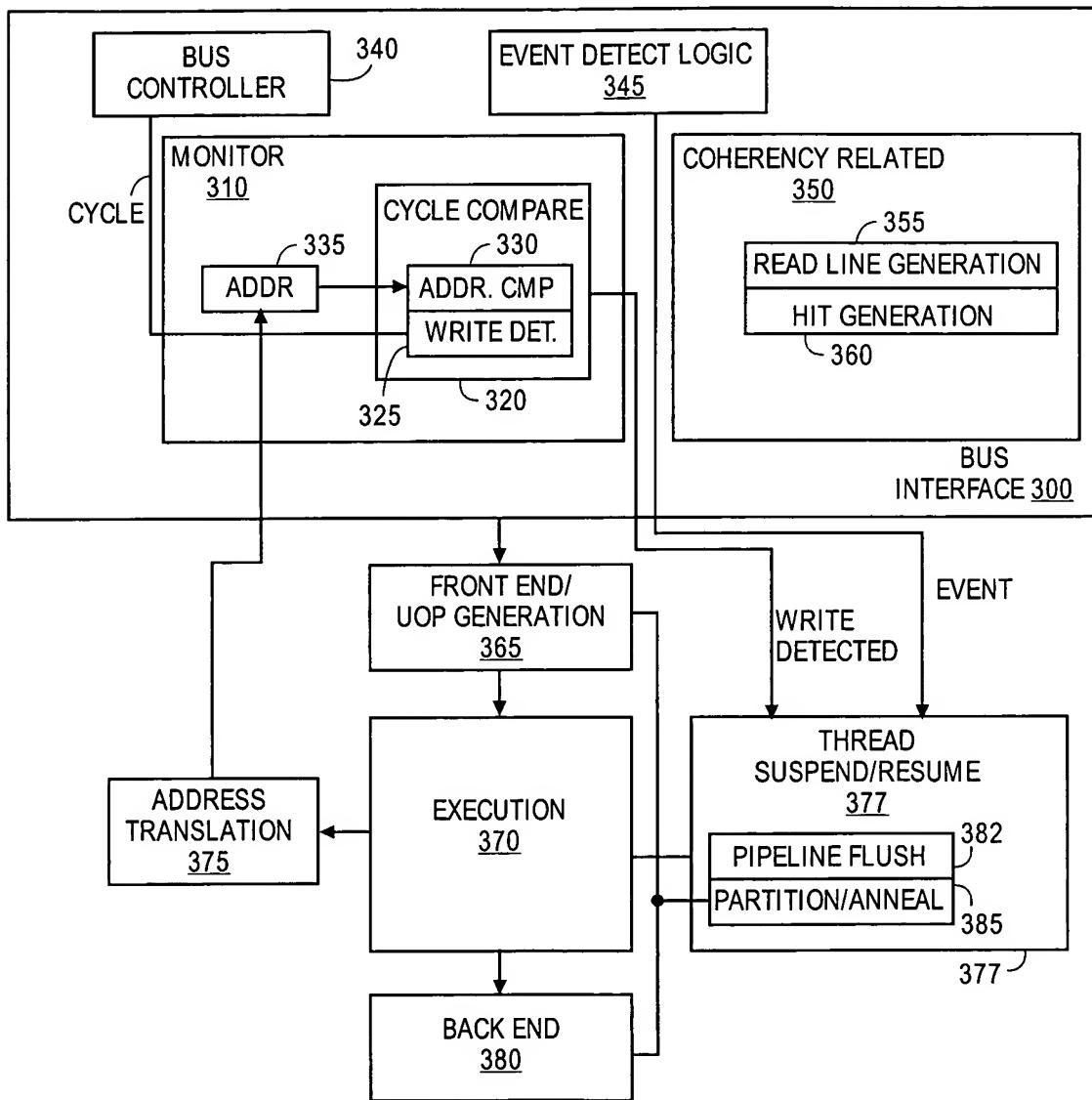Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 4/13

FIG. 4

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Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 5/13

RECEIVE MONITOR OPERAND AND ASSOCIATED ADDRESS IN THREAD 1 — 500

RECEIVE MEMORY WAIT OPCODE IN THREAD 1 (UNMASK MONITOR BREAK EVENTS) — 505

ACTIVATE AND OPERATE MONITOR (FIG. 6) — 510

MONITOR EVENT PENDING? — 515

NO

MONITOR ACTIVE? — 520

NO

YES

YES

SUSPEND FURTHER T1 EXECUTION — 525

FLUSH PIPELINE — 530

RELINQUISH T1 PARTITIONED RESOURCES AND ANNEAL FOR OTHER THREADS — 535

MONITOR WRITE EVENT? — 540

YES

FLUSH PIPELINE — 560

NO

RE-PARTITION RESOURCES — 570

OTHER EVENT? — 545

YES

NO

RESUME/CONTINUE THREAD 1 — 580

TIMER EXPIRED? — 550

YES

NO

FIG. 5

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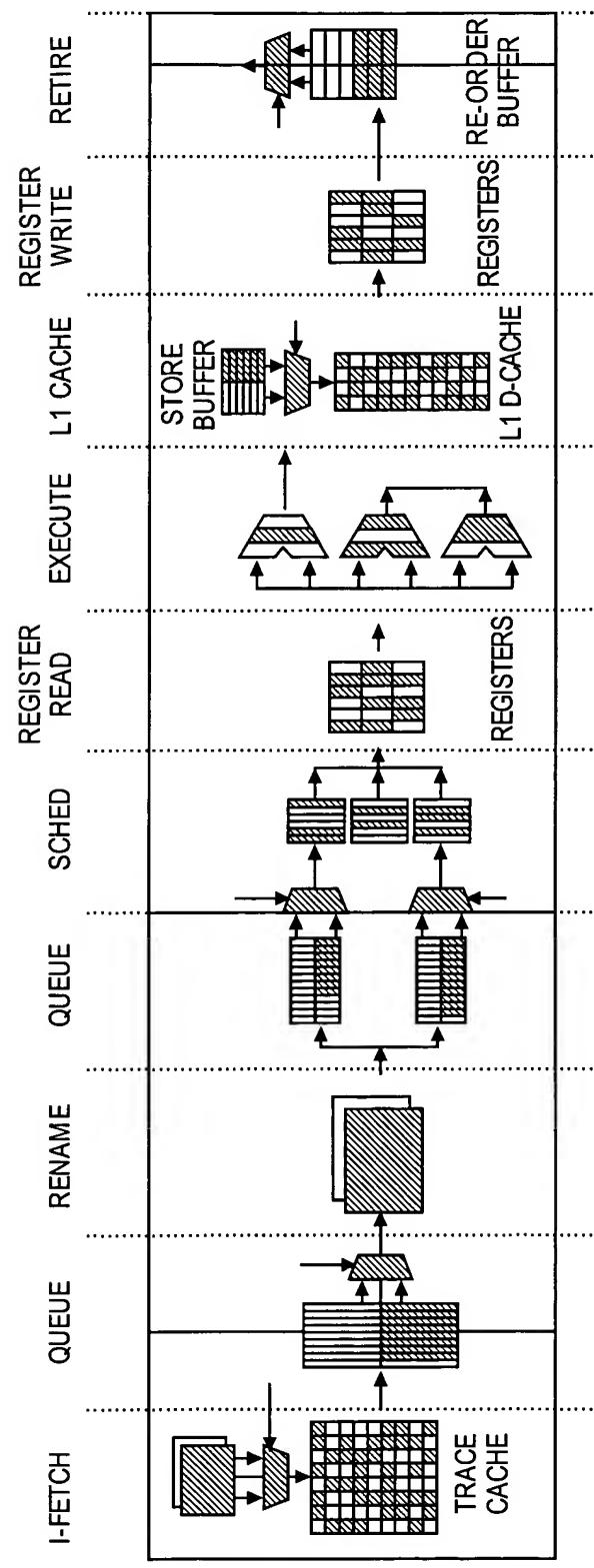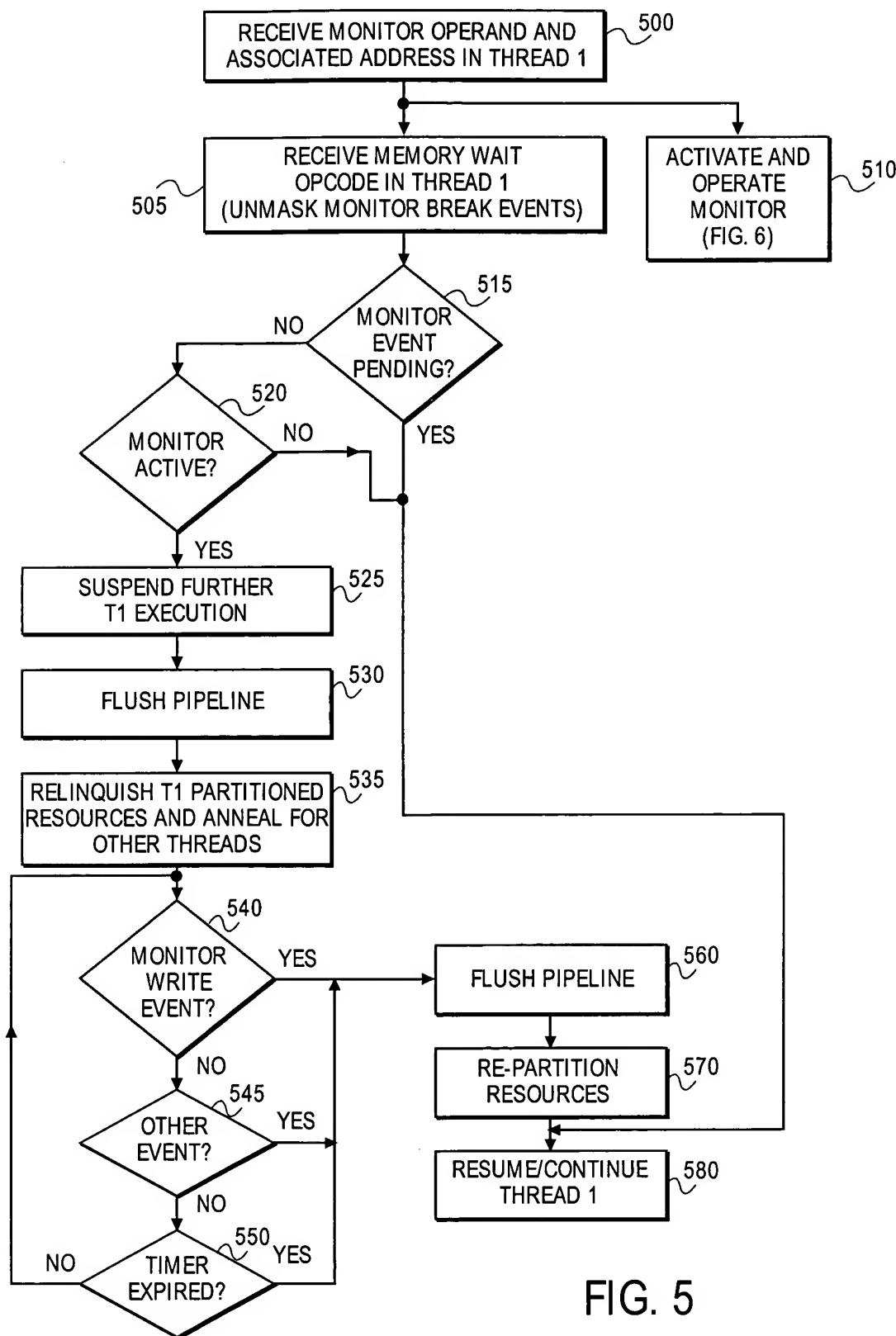Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 6/13

STOP FRONT END — 600

TRANSLATE LINEAR ADDRESS TO PHYSICAL ADDRESS — 605

ENHANCE OBSERVABILITY OF WRITES TO MONITORED ADDRESS (FIG. 6B) — 610

STORE PHYSICAL ADDRESS FOR MONITORING — 615

ENABLE MONITOR: BEGIN MONITORING BUS CYCLES FOR WRITES TO PHYSICAL ADDRESS (FIG. 7) — 620

EXECUTE STORE FENCE — 625

MATCH? — 630
NO
YES

SET MONITOR. EVENT PENDING BIT — 635

FIG. 6A

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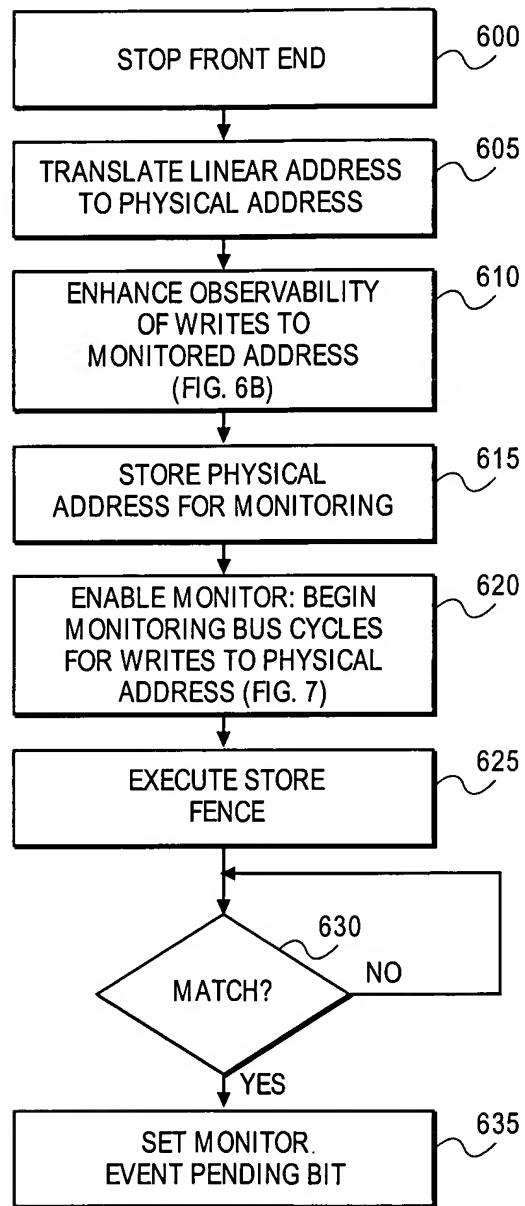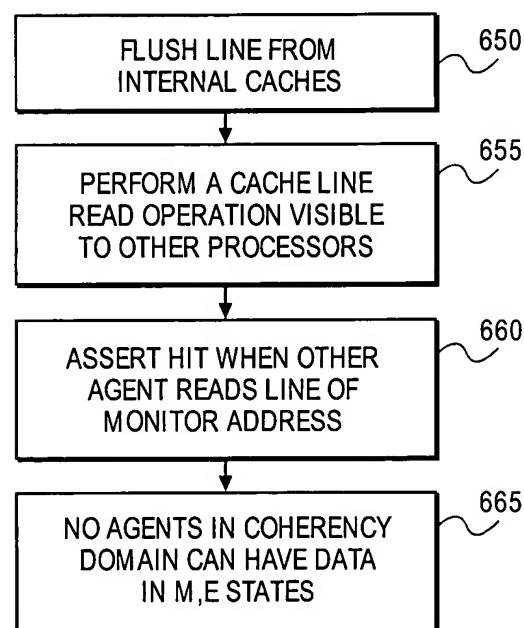Sheet: 7/13

FLUSH LINE FROM
INTERNAL CACHES   650

PERFORM A CACHE LINE
READ OPERATION VISIBLE   655
TO OTHER PROCESSORS

ASSERT HIT WHEN OTHER
AGENT READS LINE OF   660
MONITOR ADDRESS

NO AGENTS IN COHERENCY
DOMAIN CAN HAVE DATA   665
IN M,E STATES

FIG. 6B

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Sheet: 8/13

RECEIVE REQUEST AND ADDRESS PHASE INFORMATION OF BUS TRANSACTION ~700

EXAMINE CYCLE TYPE AND ADDRESSES AFFECTED ~710

NEITHER READ NOR WRITE TO MONITOR ADDRESS

WRITE TO MONITOR ADDRESS

READ OF MONITOR ADDRESS

SET MONITOR EVENT PENDING INDICATOR ~720

HALT MONITOR ~730

ASSERT SIGNAL (E.G., HIT#) TO PREVENT AGENT FROM GAINING OWNERSHIP WHICH WOULD ALLOW FUTURE WRITES WITHOUT COHERENCY BROADCASTS ~740

FIG. 7

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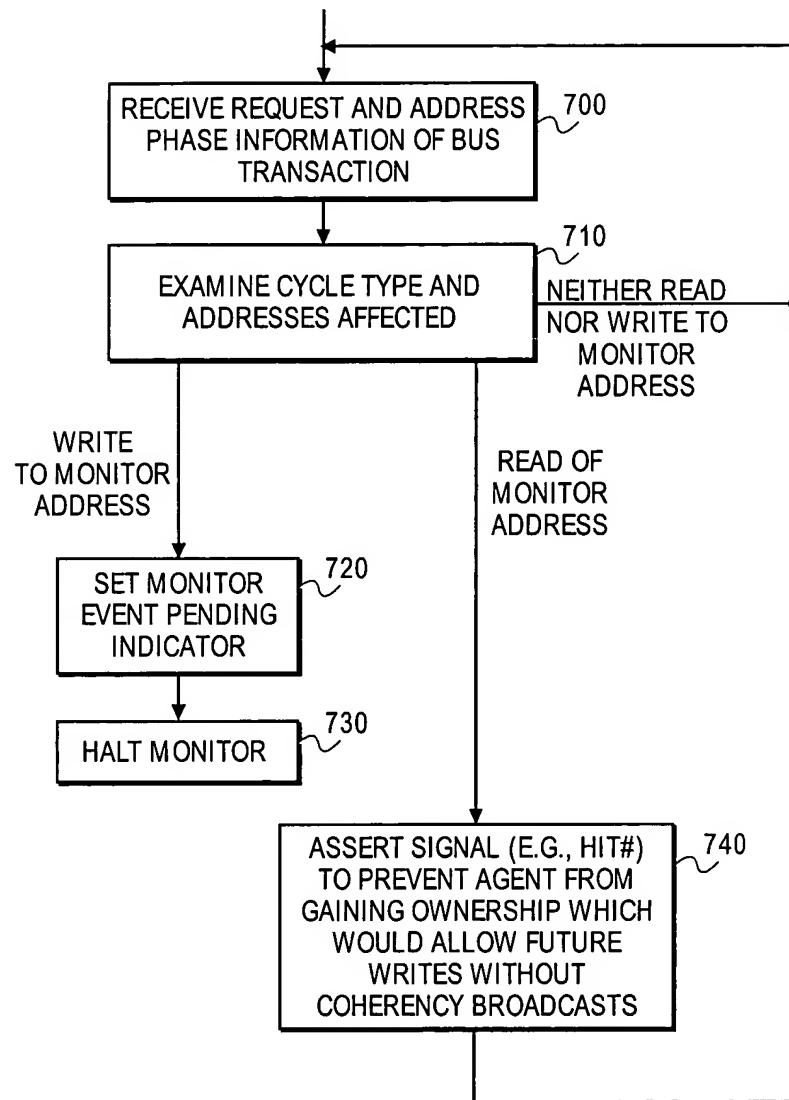Sheet: 9/13

FIG. 8

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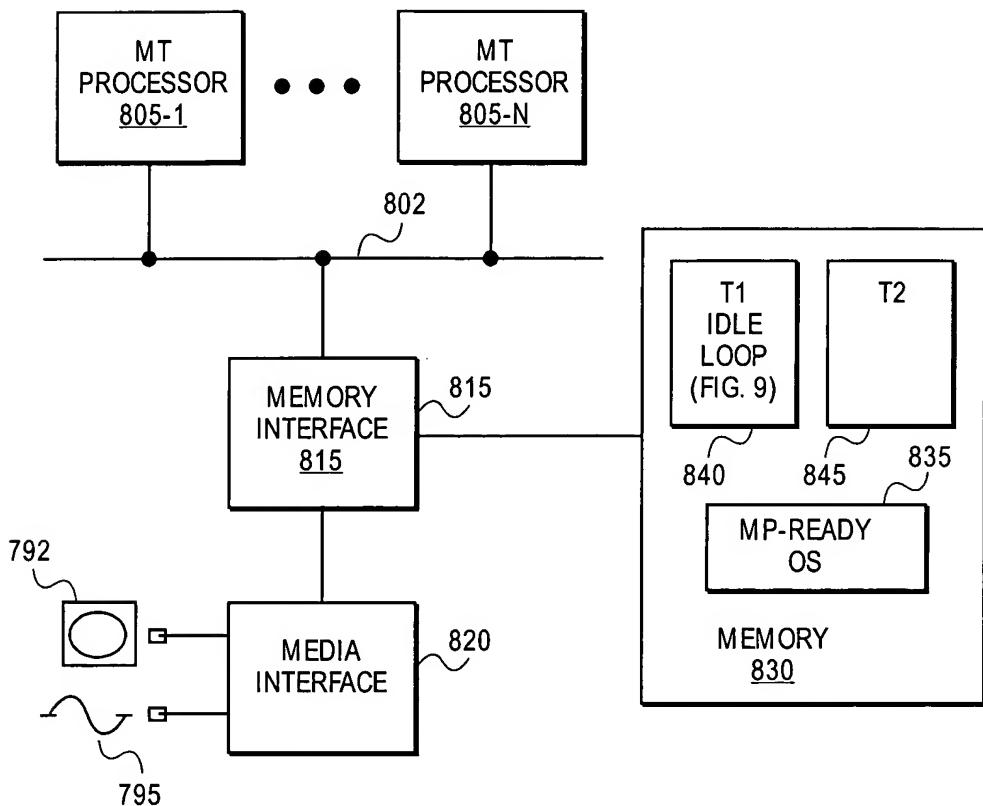Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 10/13

MONITOR ADDRESS 1 ～905

MWAIT ～910

BREAK EVENT ～915

VALUE CHANGED? ～920
NO
YES

CONTINUE THREAD EXECUTION ～922

FIG. 9A

MONITOR ADDRESS 1 ～925

CHECK ADDRESS 1 VALUE ～930

VALUE CHANGED? ～935
YES
NO

MWAIT ～940

BREAK EVENT ～945

FIG. 9B

VALUE CHANGED? ～950
NO
YES

CONTINUE THREAD EXECUTION ～952

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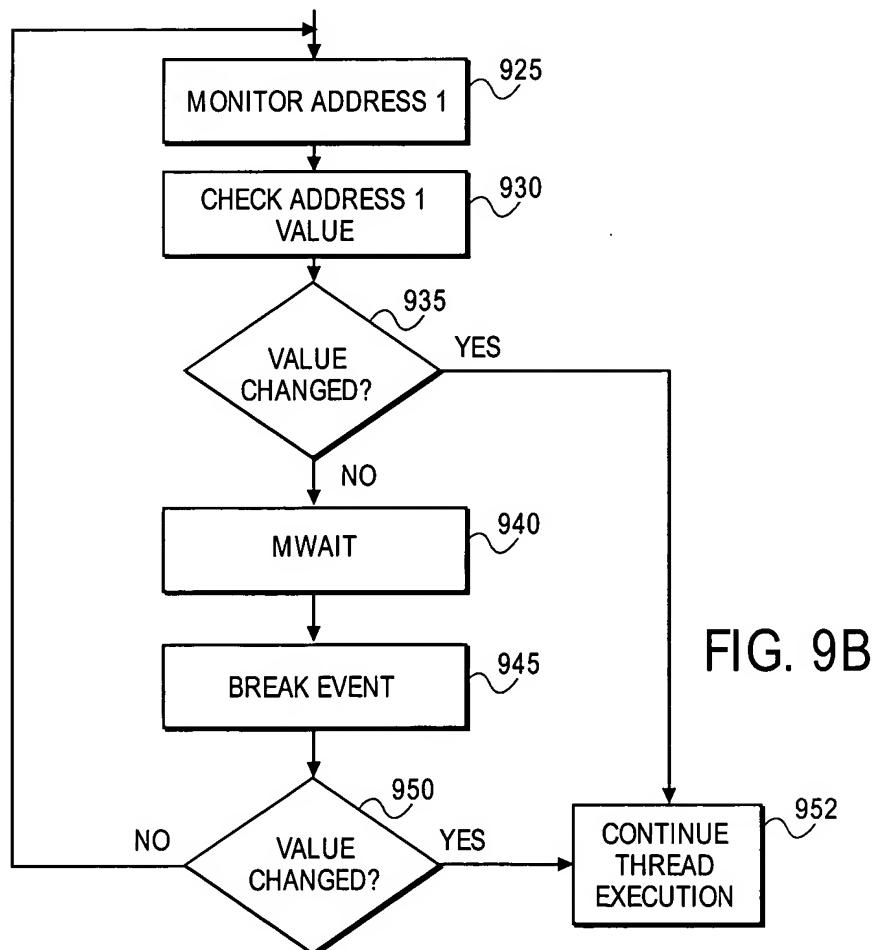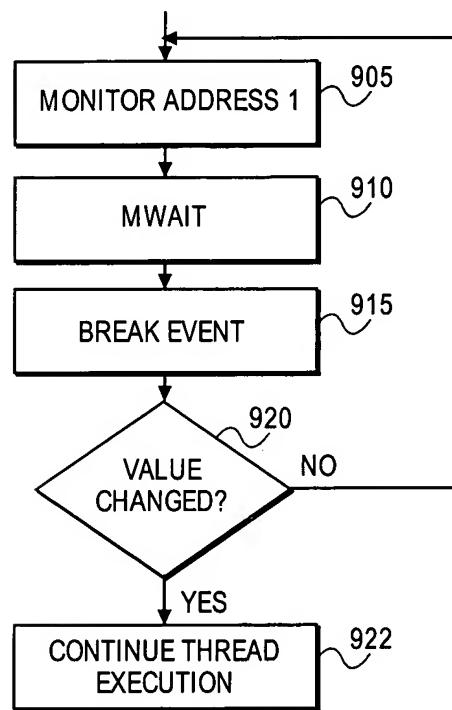Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 11/13

MONITOR WORK LOCATION 1 (WL1)
(SAME CACHE LINE AS WL2) — 955

WL1=
CV1? — 960

YES → SCHEDULE WORK
RELATED TO WL1 — 965

NO

WL2=
CV2? — 970

YES → SCHEDULE WORK
RELATED TO WL2 — 975

NO

ENOUGH
TIME? — 980

YES → CALL C STATE
HANDLER — 985

NO

MWAIT — 990

BREAK EVENT — 995

FIG. 9C

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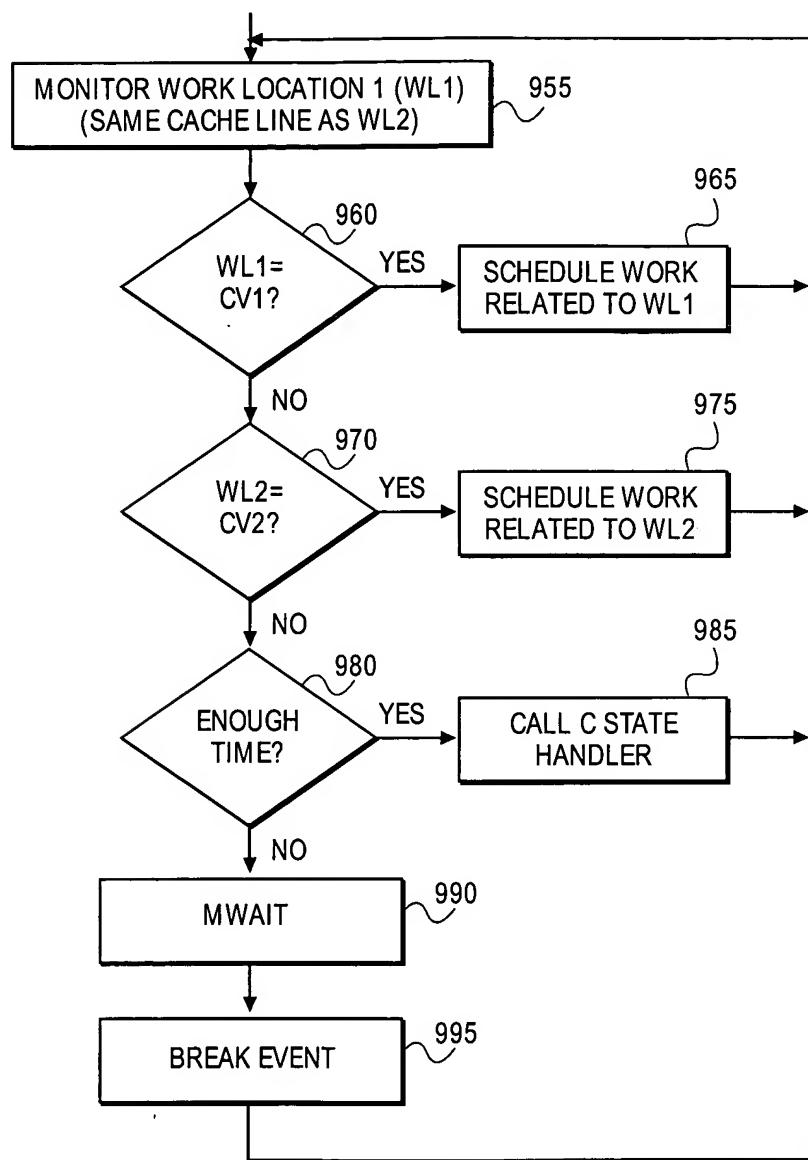Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 12/13

BREAK

EXECUTION
UNITS
1005

L1 CACHE

MONITOR LINES

1010

ADDRESS

MONITOR
1050

WC BUFFERS
1020

INCLUSIVE
L2 CACHE
1030

SNOOP
PORT

1044

BUS
INTERFACE
1040

1045

FIG. 10

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Application No.: 10/039,579   Docket No.: 42390P12496
Sheet: 13/13

FABRICATION

HARDWARE
MODEL
(HDL OR PHYSICAL
DESIGN DATA)
1110

SIMULATION
SOFTWARE
1120

1140

1150

1160

STORAGE MEDIUM 1100

FIG. 11